LOUISIANA WILD LIFE & FISHERIES COMMISSION

REFUGE DIVISION

"Erosion of Canal Banks on The Rockefeller Wildlife Refuge"

By

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ROCKEFELLER REFUGE CANAL STUDY

Advance Summary

The oil company canals on Rockefeller Refuge are widening at an alarming rate. The average width of canals in the Humble System is now 212 percent of the original width. Canals of the Superior System are 242 percent of the original width, about 2½ times. The Humble System canals are currently widening at an average rate of 0.353 feet per month. Canal berms and levees in marsh areas are not resistant to erosive forces. Therefore, canals will widen in direct ratio to usage. At the present time on Rockefeller Refuge, oil company canals and levees comprise 1182.31 acres of land area.

Introduction

In recognition that a real problem existed in the continued widening of oil company canals on Rockefeller Refuge, Mr. Richard K. Yancey, Assistant Director, Louisiana Wild Life and Fisheries Commission, requested that a study of canal widening be initiated. In May 1958, eleven locations were selected for study, four on the Superior canal system and seven on the Humble canal system. These canal locations have been profiled three times in the course of the investigation. This report presents the results of the study.

The writer's background for this report is partially based upon knowledge gained while making a geological study of Rockefeller Refuge during 1954, and while employed as geologist, Refuge Division, Louisiana Wild Life and Fisheries Commission, from February 1955 to July 1957. Conclusions stated in this report, and opinions expressed therefrom, are the writer's.

Humble System

History. Humble Canal was constructed in 1940. It was 65 feet in width and extended from East End Headquarters on the Grand Chenier Ridge Complex to Joseph Harbor Bayou, a distance of 5.26 miles. The well site was two miles east of the mouth of Joseph Harbor Bayou and the access canal departed the bayou near its entrance to the Gulf. The well proved to be a dry hole and the canal was allowed to fill with sediment and the levees to deteriorate. In the fall of 1953, the canal from Joseph Harbor Bayou to the ridge was redredged to a width of 65 feet. At a point 3.58 miles from the ridge a new canal was dredged to a point approximately 3 miles to the east. In the course of the field development, 4.29 miles of canal were dredged. In the spring of 1955, the levees of Humble Canal, except for its east levee south of the Union Producing junction were reworked. In January of 1956, the vicinity of the Humble dry hole was reopened to exploration (Royalite lease) and a portion of the old Humble canal east of Joseph Harbor Bayou was utilized in the dredging of 5.19 miles of canal. The entire Humble system totals 14.72 miles of canal, however, 5.19 miles of this total is not in use.

Canal Widening Data. Canals widen in direct ratio to usage. Thus, during the exploration and development period of an oil field system, the canals widen at their greatest rate. Later, during the production period, the rate of widening levels off, and is confined to the canals leading to gauging, pumping, and other field maintenance stations. Therefore widening rates should be considered as related to exploration and devleopment, and secondly, as occurring during the production period.

The first profiling of the canals and levees, May 1958, determined widening rates for the exploration and development period. During this period, the Humble canal system average rate of widening was 1.16 feet per month. The production period rate, May 1958 to March 1961, average is 0.428 feet per month. The data is tabulated as follows:

Humble System - Location 1

Humble Canal - 200 yards south of East End Headquarters

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	127 feet	137 feet
Increase	62 feet	72 feet
Percent of initial width	195 %	211 %

Rate of increase, May 1958 to March 1961 - 0.294 ft. per month

Humble System - Location 2

Humble Canal - East-West section

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	136 feet	156 feet
Increase	71 feet	91 feet
Percent of initial width	209 %	240 %

Rate of increase, May 1958 to March 1961 - 0.588 ft. per month

Humble System - Location 3

Humble Canal - 200 yards north of Union Producing Junction

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	143 feet	162 feet
Increase	78 feet	97 feet
Percent of initial width	220 %	249 %

Rate of increase, May 1958 to March 1961 - 0.559 ft. per month

Humble System - Location 4

Union Producing Canal - 200 yards east of Humble Canal

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	110 feet	130 feet
Increase	45 feet	65 feet
Percent of initial width	169 %	200 %

Rate of increase, May 1958 to March 1961 - 0.588 ft. per month

Humble System - Location 5

Humble Canal - 200 yards south of Union Producing Junction

	May 1958	March 1961
Initial width	65 feet	65 feet

Present width	124 feet	134 feet
Increase	59 feet	69 feet
Percent of initial width	191 %	206 %

Rate of increase, May 1958 to March 1961 - 0.294 ft. per month

Humble System - Location 6

Humble Canal - $\frac{1}{2}$ mile south of Union Producing Junction

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	118 feet	136 feet
Increase	53 feet	71 feet
Percent of initial width	182 %	209 %

Rate of increase, May 1958 to March 1961 - 0.529 ft. per month

Humble System - Location 7

Royalite Canal - $\frac{1}{4}$ mile east of Joseph Harbor Bayou

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	105 feet	109 feet
Increase	40 feet	44 feet
Percent of initial width	162 %	168 %

Rate of increase, May 1958 to March 1961 - 0.118 ft. per month

Evaluation. For the exploration and development period of the Humble system, the rate of canal widening (1.16 ft. per month) was slightly less than normal. This was expected, for remnants of the original levees served as compacted artificial berms when the second dredging of the canal resulted in the new levees being placed slightly behind the original levees. Now, during the production period, since most canal levees have received a second or third lift and in many cases also reshaped, their resistance to wave attack is constant for most marsh types. This means that canal width (wind driven waves play a significant part) and boat traffic are the variables. The average rate of widening for Humble Canal to the Union Producing Deep Lake field (Locations 1, 2, 3, and 4) is 0.507 feet per month. Location 1, is below the average, for this section is near the docking area and therefore boats are at slow speed. The portion of Humble Canal south of the Union Producing junction, Locations 5, and 6,

showed 0.294 and 0.529 feet per month. The location with the higher rate, Location 6, is in an area of poor marsh stability. In addition, the east levee has not received equivalent levee maintenance. The Royalite Canal has received very little usage and is widening at a rate of 0.118 feet per month.

Superior System

History. Construction of Superior Canal began in the winter of 1951-52. The canal entered the Refuge from the north on the section line between sections 33 and 34 of T 15 S, R 3 W. Exploratory wells were drilled and two oil fields were discovered. Deep Lake Field was developed first and is located in the north central sections of T 16 S, R 3 W. This field has 30 well locations. Development of the Constance Bayou Field began in September 1954. This field, located in the east central sections of T 16 S, R 3 W, has 9 well locations. Within this same period and in the immediate area, the Royalite Corporation drilled three exploratory wells and used the Superior Canal for access. The Superior system has a total of 16.0549 miles of canals and well locations. The canal system is a fresh water system and all canals and well locations are enclosed with levees. In the course of the Rockefeller Refuge development program, 2.5814 miles of the Superior system had both levees raised and reshaped, and 2.2045 miles had one levee raised and reshaped. Where the main canal crosses [illegible] been rebuilt three times. In each instance, the additional material was obtained from the canal bottom.

Canal Widening Data. As stated earlier, canals widen primarily as a result of wave action created by boat traffic. During the exploration and development period, considered as ending in May 1958,

widening rates varied from 1.224 feet per month for the Deep Lake Field area to 1.636 feet per month in the Constance Bayou Field area. To date, for the production period, the average rate of widening has been 0.353 feet per month.

Deep Lake Field - Location 1

Main Canal - Center of Section 4, T 16 S, R 3 W

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	158 feet	171 feet
Increase	93 feet	106 feet
Percent of initial width	243 %	263 %

Rate of increase, May 1958 to March 1961 - 0.382 ft. per month

Deep Lake Field - Location 2

Main Canal - NW corner of NE ¼ of Section 15, T 16 S, R 3 W

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	137 feet	153 feet
Increase	72 feet	88 feet
Percent of initial width	210 %	235 %

Rate of increase, May 1958 to March 1961 - 0.471 ft. per month

Constance Bayou Field - Location 1

Main Canal - Center of SW ¼ of Section 14, T 16 S, R 3 W

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	150 feet	159 feet
Increase	85 feet	94 feet
Percent of initial width	231 %	245 %

Rate of increase, May 1958 to March 1961 - 0.265 ft. per month

Constance Bayou Field - Location 2

Main Canal - Center of NE ¼ of Section 23, T 16 S, R 3 W

	May 1958	March 1961
Initial width	65 feet	65 feet
Present width	137 feet	147 feet
Increase	72 feet	82 feet
Percent of initial width	210 %	226 %

Rate of increase, May 1958 to March 1961 - 0.294 ft. per month

Evaluation. The Superior system extends through a soft, unstable Spartina patens marsh. This is reflected in the high rate of widening for the exploration and development period of the fields, 1.224 and 1.636 feet per month. In this length of time the canals have widened

to the levees themselves and are now being eroded. In the Deep Lake Field, Location 1 receives the most traffic and this is indicated by the rate, 0.382 feet per month. Location 2, Deep Lake Field, is in the poorest marsh section (Grassy Lake) and this is shown by a corresponding high widening rate, 0.471 feet per month. The Constance Bayou Field locations have the same marsh type and receive approximately the same traffic. They widened 0.265 and 0.294 feet per month.

Canals and Levees - Cost in Land

Construction Specifications. Canals for oil field exploration on Rockefeller Refuge were dredged 65 feet in width and the spoil placed to make continuous levees on both sides of the canal. Marsh conditions dictate the height the levees will stack and correspondingly the distance the spoil will extend on either side of the levee centerline. A levee cross-section of the west levee of the Constance Bayou Field main canal, taken one week after placement, showed the toe of the levee to be 30 feet from the canal edge, the base width of the levee to be 82 feet, and the levee height to be 5.5 feet, mean gulf level. The overall width for the canal and its two levees was 306 feet. The marsh in the Deep Lake Field is slightly different and a typical levee and canal cross-section there measures (canal and two levees) a total of 340 feet. On Humble Canal the average canal and levee width is 239 feet. Union Producing Canal is 284 feet and Royalite Canal, 312 feet.

Land Usage - Humble System. The area of land lost to refuge management because of canal construction extends from the outside toe of one levee to the outside toe of the other levee. On Humble Canal the average land loss is 28.99 acres per mile of canal. Union Producing Canal averages 37.16 acres of land lost per mile of

canal and the Royalite Canal, 37.82 acres per mile. The entire Humble system comprises 504.36 acres of land used as a result of canal construction.

Land Usage - Superior System. In the Superior system, the main canal of the Deep Lake Field shows a land usage or loss to management of 41.25 acres per mile of canal. The main canal of the Constance Bayou Field shows a land usage of 37.18 acres per mile of canal. The average land usage rate for the main canal in both fields, based on four locations, is 40.40 acres per mile of canal. The total area of land lost to refuge management from canal and well site construction is 677.95 acres.

Conclusions

1. Canals on Rockefeller Refuge are widening at a rate directly related to usage. The variables that influence this rate, in the order of their importance, are: boat traffic, boat speed, levee construction and maintenance techniques, marsh type, and canal width.

2. Rates of widening of oil company canals are greatest and most erratic in the exploration and development period. Canal berms, which erode easiest, are attacked first. Canal traffic is heaviest in this period.

3. Rates of widening of oil company canals are less and more constant in the production period. Canal berms are now gone and the more resistant levees are under attack. Canal traffic is lighter in this period.

4. Complete control of canal widening is not possible through earthwork alone.

5. Canal widening can be regulated through restricted usage,

or expensive construction techniques, such as bulkheading and berm mattresses.

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